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In the Matter of Broadband Accessibility for People with Disabilities – Workshop II Barriers, Opportunities, and Policy Recommendations	)	GN Docket Nos. 09-47, 09-51, 09-137

Comments of the Rehabilitation Engineering Research Center
on Universal Interface and Information Technology Access
at the University of Wisconsin's Trace R&D Center

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Introduction

The Rehabilitation Engineering Research Center on Universal Interface and Information Technology Access at the University of Wisconsin's Trace R&D Center commends the Federal Communications Commission (FCC or Commission) for seeking broad input from the public on the accessibility topics raised in its September 18th Public Notice. We especially appreciate the considerable effort being made to understand the complex nature of this area, as evidenced by the questions asked in the Public Notice.[1]

We will try to group our answers under the same topics as they were asked. Where questions cut across topic areas, we will first address them generally and then follow with area-specific responses.

Most of the questions deal with broadband access, although there are some telecommunications (e.g., telephone-like) issues related to VoIP. This document will deal with the more general broadband issues, and a separate document will be submitted related to the VoIP issues by our affiliated Telecommunication Rehabilitation Engineering Research Center.

The Trace R&D Center has been working in the area of technology and accessibility for over 30 years and it was this Center that created the initial accessibility features (e.g., mouse keys, sticky keys) that are now built into every copy of the Windows operating system, the Macintosh operating system, Linux, etc. The Trace Center also created the first set of Web accessibility guidelines in 1995 and has worked with over 50 companies in building accessibility directly into their products. Cross-disability accessibility features developed by the Trace Center can also be found in automated postal stations throughout the country, Amtrak ticketing machines, ATMs, airport information systems, and voting machines.

[1] *Comment Sought on Broadband Accessibility for People with Disabilities, Workshop II: Barriers, Opportunities, and Policy Recommendations,* NBP Public Notice #4, DA 09-2080, GN Docket Nos. 09-47, 09-51, 09-137 (September 18, 2009) ("Public Notice").

The Trace Center is also one of the founding leaders of a large consortium of organizations and individuals coming together to form the Raising the Floor initiative (http://raisingthefloor.net). Raising the Floor (RtF)[2] is an international initiative to help ensure that people facing disability, literacy, or aging related barriers to accessibility can access the rich resources and services on the Internet regardless of their socioeconomic situation.

Comments to FCC Questions that Cut Across Discussion Topics

What statistics are available for Internet use by people with different disabilities?

We have found that reliable statistics on Internet use by people with disabilities are extremely hard to find and usually limited to particular groups. Web surveys are by definition limited to those who already have Internet access; and phone surveys leave out people with telephone-related disabilities and those who have only cell phone or text-only access. In addition, things are changing so rapidly that the numbers from the past may have little meaning today. We would encourage the Commission to support improved efforts to gather data about consumers with disabilities, both as independent studies and as part of general consumer research.

Even without hard data, it is very likely that the percentage of people with disabilities who are using advanced information and communication technologies (ICT) is profoundly affected by three factors:

1. Ability – The ability of individuals to effectively access and use the Internet. When the physical and sensory demands of the Internet are not sufficient to dissuade or prevent people with disabilities from using the Internet, the complexity of the Internet (directly or when you try to access it through

[2] http://RaisingTheFloor.net.

assistive technologies) often is. The number and percentage of people who would use the Internet and its resources if it had an inclusive interface cannot necessarily be determined by the number that currently can or do use it today.

2. Need – Twenty years ago there was no "need" to use the Internet, and even ten years ago most things could be accomplished in another fashion. Today there are many things that can ***only*** be done through the Internet. For example, in order to apply for a job with the overwhelming majority of Fortune 500 companies, one must fill out an Internet application. In ten years there may be few people who can opt out of using the Internet for education, employment, daily living, and personal safety.

3. Economics – All studies of income and employment among people with disabilities indicate great disparity, and some types of assistive technology are prohibitively expensive (see next section for an expansion of this issue.)

The importance of making the Internet accessible should not be determined based upon the number of people with disabilities who currently can and do use the Internet but rather by the number that will need to in order to participate in employment, education, health systems, our political process and emergency and disaster survival.

Is affordability a problem?

There are many different studies that talk about the unemployment rate amongst persons with disabilities. Unemployment rates are all quite high to extremely high for individuals with more severe disabilities. Internet and broadband services provide some of the best opportunities for individuals with disabilities to gain employment as well as to gain specialized education or training to better equip them to be employed. Even those who are not successful in gaining employment can use broadband to be productive and to serve their peers or the country. At the same time, the high unemployment rate makes it very difficult for them to afford access.

As a society, we have come to believe that access to broadband is so important that it must be made available for free, at public access points at libraries, community centers, government facilities and in other locations. However, individuals who need specialized interfaces in order to use broadband services cannot make use of these free, public

facilities. Furthermore these facilities only have limited abilities today to be able to provide the variety of alternative interfaces needed to meet the needs of people with differing types, degrees and combinations of disability.

The cost for assistive technologies (AT) that are powerful enough to handle new technologies that are constantly being introduced on the Web are quite high. For people trying to meet housing, food, and clothing costs, the cost to purchase and continually update such technologies is beyond their reach. It is also proven to be beyond the reach of the public access points to find the funding to purchase all the different types and variations of assistive technologies, much less to maintain them on their public computers using our current models for providing access.

Availability/Existence

Affordability is not the only problem at this time. The high cost for developing and maintaining key types of assistive technology that will work with the constantly changing mainstream computer and Internet technologies makes it very difficult for companies to develop new assistive technologies or new companies to enter into the assistive technology market. The small and fragmented nature of the market only compounds this problem.

As a result, it is much harder to develop new approaches, to test new techniques and to bring new adaptive products to market and keep them up to date. We are just beginning to see effective assistive technologies emerging for some disability groups, and other disability groups, such as those who are deaf-blind, continue to be poorly served or served through adaptations of assistive technologies designed for other disability groups.

Reducing Burden on Authors and Developers

The lack of effective and affordable assistive technologies also increases the burden on authors and developers of both web applications and content. Creating an accessible web

page or application involves either designing it so that it can be directly accessed by people with the full range of types, degrees, and combinations of disability, or ensuring that it will work with the assistive technologies that these individuals have.

- Where accessibility features are not built into the underlying systems and software, authors must rely on compatibility with different assistive technologies.

- When the assistive technologies are less powerful or effective, web and software authors must do more work in order to create products that will be usable with assistive technologies.

- So when good assistive technologies are too expensive, users will end up using less capable assistive technologies, which will in turn increase the cost in time and money on the part of authors and developers.

The burden on authors and developers can be reduced by developing a National Public Inclusive Infrastructure (discussed more fully below), which will:

- Build access features directly into the infrastructure (hardware, software, and network services)

- Provide better mechanisms for mainstream IT developers to couple their products to access features and technologies (e.g., better APIs, more use of common access strategies and tools)

- Make it easier for assistive technology developers to create products and maintain compatibility with the evolving mainstream IT, thus lowering their costs and allowing greater focus on innovation and new disabilities

- Increase the capability of free and built-in access features that are available, thus providing "raising the floor-level" technologies that authors can assume users have available to them

Reducing the Burden on Government and Society

Most of the cost for assistive technology is not borne by companies or agencies that employ people with disabilities. It is borne by society in the form of public payments for the purchase of assistive technologies or services. In addition, it is estimated that the

costs for individuals who do not have the technologies they need to live more independently (that is the cost for people becoming dependent sooner or becoming a greater burden on a relative to the point where the relative can no longer take care of them) results in even greater cost to society than the assistive technologies.

When we have opportunities to lower the cost to create effective assistive technologies, we obtain two benefits. First, we save the costs to society to provide such technologies. Second, if we can lower them sufficiently, we also increase the probability that we will be able afford to provide these technologies to more people who need them.

If we couple the fact that access to information technologies and the web is becoming non-optional, with the fact that it will become increasingly expensive to provide everyone with a disability with the external access features that they need, it becomes clear that we need to explore mechanisms to increase the ubiquity of built-in accessibility. The goal is to ensure that as many people as possible will be able to use information technologies and the web as they encounter it, without the need to purchase additional adaptive technologies. That is, that the access features they need to access the Internet are called up automatically from their preferences profile without them having to install or configure new software to use that computer. This can increase the ability for less technical people to use the web, especially our aging population. In addition, we need to explore mechanisms to lower the costs, and increase the market penetration for manufacturers of assistive technologies for individuals (with multiple or more severe disabilities) whose needs cannot be met with built-in accessibility.

What problems do people with disabilities face, and what are the most important broadband apps?

In general, the broadband apps that are most important are those that are most essential to daily living. This includes everything from education to government information sites and services, to shopping, emergencies (especially for those who have trouble getting out, or need special devices), etc. This is a long list that is difficult to capture.

Perhaps the more important question is: Which information or services, including telecommunication, are ***not*** important for individuals with disabilities to have access to?

In addition, in planning for the future, it is not clear that identifying applications that are important ***today*** is helpful.

Broadband services are revolutionizing our world in the same way that electricity revolutionized our societies in the past. Asking which applications of information technology will be the most important for a group of people to have access to may be like asking people in the past which applications of electricity were the most important. It misses the point that there are unlikely to be any activities in the future that do not involve and require access to broadband information and services in the same way that electricity is ubiquitous today. There is virtually nothing today that does not involve the use of electricity. Network based information services will be woven throughout everything we do, and every object we interact with. And having these systems be accessible can greatly increase the potential of people who have disabilities, including people who are older. Conversely, not having access could substantially marginalize these individuals. Given the rapid rate at which information technologies are being incorporated into every aspect of our society, the systematic incorporation of networked and broadband services is likely to occur within one or two policy cycles. For this reason, we need to lay the policy foundation for universal access now.

Ubiquitous Computing

The importance of taking action that fully addresses the needs of people with disabilities is further emphasized when we realize that we are approaching a time when what we think of as being personal computers and communication devices will be integrated into our environment in the same fashion that electricity and light are built-in today. There was a time when one did not assume that there would be light in a room unless a person brought it into the room in the form of a candle or lantern. No one at that time could

have foreseen that one day there would not only be light in any room that people went into, but that no one would even need to carry a light when they went outside. Just as we now have lights everywhere (even in closets), so too will computers become ubiquitous. We need to be ready with a way for all computers to provide the accessible features needed by people with varying disabilities before that time arrives.

What are some of the key actions that the FCC can take to facilitate disability access?

Net Neutrality

Net Neutrality is key to allowing people with disabilities to be able to use whatever technologies will work best for them and to secure their information from whichever sources are most usable by them.[3] This is because people with disabilities often have to use a different device or software program to access Internet content than would people without disabilities. Any restrictions on the ability of users to use whichever technologies they need to access the Internet can restrict the ability of people with disabilities to access the Internet effectively or at all. For example, people with disabilities may have to use a more accessible technology than the one that is provided by the user's Internet service provider (ISP). This may be because the competitor's product works better with the person's assistive technology or it may have built-in access features that the software offered by the user's regular ISP does not. Or people with disabilities may have to secure their media and information from sites other than that preferred by an ISP (or that provided by an ISP's partner). The alternate source may provide more accessible information or it may provide a more accessible web interface to their services.

[3] A fuller discussion of this can be found in the testimony on net neutrality that was prepared for the Canadian Radio-television and Telecommunications Commission (CRTC) They can be found at
http://www.crtc.gc.ca/public/partvii/2008/8646/c12_200815400/1029920.zip,
http://www.crtc.gc.ca/public/partvii/2008/8646/c12_200815400/1249754.zip,
http://www.crtc.gc.ca/public/partvii/2008/8646/c12_200815400/1109714.zip,
http://www.crtc.gc.ca/public/partvii/2008/8646/c12_200815400/1245754.zip
also
http://www.crtc.gc.ca/public/partvii/2008/8646/c12_200815400/1008694.DOC
http://www.crtc.gc.ca/public/partvii/2008/8646/c12_200815400/1249615.DOC

Discriminating by Internet traffic type can also discriminate against individuals with disabilities. For example, not all peer-to-peer services are file sharing. Peer-to-peer technologies are used for many legitimate purposes and some disability access features and services are carried out using peer-to-peer technology. Blocking all peer-to-peer activity in order to control particular high-bandwidth-using p2p services can therefore cause accessibility problems with services that are not the problem. Additionally, assumptions about patterns of user activity may not apply to people with disabilities. For example, the amount of bandwidth needed for two or three simultaneous phone calls in a household is much higher for individuals using sign language for video communication over the Internet than for individuals who are just using audio (although still much lower than a single HDTV program). Also, the upload and download speeds for sign language communication would need to be symmetric and require continuous flow (QoS) where QoS and bandwidth for video is usually thought of as just a downstream issue.

In order to achieve net neutrality in a manner that will enable people with disabilities to obtain the access they need, the following characteristics must be met in the network:

- **Users must be able to connect any device,** not just devices endorsed or expected by the ISP. This allows users to find or have developed for them, devices that they are able to use. The most usable device may be a device from a competitor of the ISP or their partner(s).
- **Users must be able to draw their content from any source**, not just from sources preferred or expected by the ISP. This allows users to be able to access versions of content that are accessible to them.
- **Users must be able to use any software on their** devices and not just the software that is provided, endorsed or expected by the ISP. This again allows users to find or have developed versions of software that they can use or that will work with their assistive technologies or special display hardware (including software from competitors).
- **User must be able to use different data protocols or formats**, than those provided, preferred, or expected by the ISP. This allows users to be able to use new accessibility technologies, meta data, alternate data sources and alternate types of information that they need in order to make the mainstream content interpretable and understandable by them. Note that peer-to-peer networks are used for some disability services.
- **User must be able to access additional bandwidth up to a certain level.** This allows individuals who need video sign language in order to make a telephone call or allows both a movie and a second video stream with sign language interpretation to be received simultaneously. This additional bandwidth is not excessive and will be nominal as

bandwidths continue to expand – but are important for low bandwidth broadband today. [4]

- **All of these should be without any financial or performance penalty.**

Should Universal Service Funds be used to pay for broadband services in order to have access to telephony?

We currently are going through a period of awkward transition where we need to support old access technology, such as TTYs, at the same time we are supporting new IP-based communication. Providing the ability for individuals to have broadband telephony at subsidized rates, such as those available through the Lifeline program, would bring the benefits of IP telephony to this population more quickly and could help to shorten the transition period where support for two technologies is needed.

Is the market more or less responsive to accessibility than in the past?

With the aging population, industry has recognized a market in individuals who are elderly. This has caused them to be more responsive for this population, particularly elders with milder disabilities. However, for individuals with more significant or multiple disabilities, there does not appear to be any significant change in the responsiveness of the market. Section 508 of the Rehabilitation Act - a law that requires the federal government to procure accessible electronic, information, and telecommunications technologies – has had some impact, though greater enforcement would substantially increase its impact. But unless there are financial rewards for building access into products or penalties for not doing so, it is unrealistic to expect companies that are in a highly competitive market in tough economic times to invest funds in accessibility (or anything) if they can get a higher rate of return investing the same effort and funds in something that will reap greater returns.

[4] See response to Chair in comments to CRTC at http://www.crtc.gc.ca/public/partvii/2008/8646/c12_200815400/1245754.zip

One example of this can be seen in governmental requests made to the wireless industry to incorporate new emergency notification and emergency communication features in their products. Since this industry is unable to charge extra for these capabilities it has taken time and pressure on the part of the FCC to achieve progress on this matter, and the full capability of technology in this area will not necessarily be deployed due to concerns about burdening industry. Disability access is in a similar situation.

Would more outreach be helpful in increasing the number of individuals who have access?

Absolutely. Awareness is one of the most difficult areas for which funding can be secured. Yet, this is one of the most important considerations in a National Broadband Plan. Individuals with disabilities simply are not aware that there are technical solutions to their accessibility problems. As a result, even information that could be found easily with an Internet search is not located because unaware that something might exist, people do not think to look for it. Public service announcements, integration into popular media, inclusion in newsletters and magazines that are read by these different target groups, are all techniques that could and should be used to reach out and make people aware of what is available.

Disability-Specific Comments to FCC Questions

Deaf and Hard of Hearing

Although individuals who are deaf do not currently encounter as many problems when interacting with the Internet beyond captioning of media as some groups, as we move into future generations of broadband services and Internet content we are likely to see much more dynamic content, including voice interaction. There will be both increased content that is auditory in nature and increased interaction in the form of speech. If content follows the new Web Content Accessibility Guidelines from the World Wide Web Consortium, these issues would be covered since equivalent visual or text information for all auditory information and interaction is required to achieve

conformance with those guidelines. It should be noted, however, that the lowest level of conformance to WCAG (Level A) would not provide access to all types of web content.

Personal telecommunications however is an area of broadband use that is quite important to individuals who are deaf and hard of hearing and one that poses issues today. As the PSTN gives way to VoIP, and telecommunications moves to IP, new opportunities as well as new potential barriers are created for persons who are hard of hearing and deaf. If properly implemented this transition can be all positive. However, as in the past, natural market forces will not take technologies in this direction without adjustment through regulation.[5]

Some of the issues that this transition will include concern:

- the clarity of voice communication for individuals who are hard of hearing
- the need to ensure the availability of real-time text wherever there is voice and
- video communication to support sign language and lip reading.

Fortunately, all of these aspects can be implemented without additional hardware requirements, making it possible to build much or most accessibility for this group directly into mainstream products. In this way it can be invoked on request as needed. Because this can be done without introducing hardware or other "running" costs (costs on a per device basis versus fixed costs that must be incurred only once when the products are originally designed) the cost over time is minimal for most of these features.

Building access directly into products can decrease the number of devices needed to be provided by equipment programs, which in turn can make more funds available to meet the needs of individuals with severe or multiple disabilities such as deaf/blindness.

As we move forward we should also be sure that policies and technologies will support future opportunities to allow technology to reduce cost – while not employing them

[5] Peltz Strauss, Karen, A New Civil Right, Telecommunications Equality for Deaf and Hard of Hearing Americans (Washington, D.C.: Gallaudet Press), 2006

before they are really effective. For example, speech to text is not good enough (and won't be for a long time) to replace relay services. However, it may soon be good enough to allow people to use it instead of a live relay operator if the person who is talking speaks clearly (and supplements with text) and the parties want privacy. Using a 'try harder' approach, people could also use speech recognition as a first (and more private option) with a 'try harder' button that would escalate the call to a human relay operator if the speech recognition was not good enough for some speakers or topics or noise environments. Such a system would allow speech recognition to be brought online over time where it is effective, and used only as an option that people can opt into and out of as they feel appropriate while on a relay call.

Speech to sign language is also a future technology that is not here today. But again we should ensure that policies are put in place that would allow users to try this approach if they choose to do so in the future. Powerful cloud based services will be able to do things in the future that are not possible today and research in areas like language translation are continually opening new vistas.

Speech Disabilities

High-clarity telecommunications is as important for individuals who have speech disabilities as it is for individuals with hearing loss. In this case, the ability to have high quality audio on your phone call can greatly increase an individual's ability to understand someone with a speech disability (whether this be the person at the other end of the call or the speech-to-speech relay operator). A higher-quality speech connection is possible in IP connections if it is supported by the technologies and the network.

As telecommunication moves to IP, IP based speech-to-speech relay services will naturally follow. If high quality or high bandwidth audio is possible on request then higher quality speech-to-speech relay service should be possible on IP then over the PSTN. If consumers do not have control of the quality of the IP audio, then some individuals will (as often happens today) find that the IP telephone connection to the

called party or the speech-to-speech relay will be ***worse*** than the PSTN, making them even harder to understand.

AAC and other AT

IP telecommunication, along with Wi-Fi and other wireless communication technologies, can provide users of augmentative and alternative communication (AAC) devices with much richer communication opportunities and better connectivity. Wireless technologies can make it possible for individuals to more easily connect to telecommunication systems than was possible with landline PSTN. The ability to use audio, text, and visual communication can allow AAC users to communicate in whichever media (audio, text or video) is most compatible with their AAC and their abilities.

One area of concern is permission to connect to a network. Today it is possible to connect in parallel with any PSTN phone, allowing the connection of TTYs or AAC devices by simply plugging a splitter into the telephone socket. With IP communication, devices need to be authorized on networks before they will work. As a result, in most any company, hotel or other controlled location, it is impossible to connect an IP device in parallel with a VoIP phone without permission from the network administrator. Some mechanism for "guest" connection of alternate telephony devices needs to be developed. Without that, individuals requiring special communication devices will not be able to use these as alternate telephones unless they maintain their own personal connection to the IP Phone network (e.g., their own cellular phone service). This is both expensive and does not work inside all buildings and in all environments. It also requires users to incur the expense of a monthly cellular bill (and possibly also data service) while their peers without disabilities can simply use the phones that are already in workplaces, public meeting places, etc.

Mobility / Dexterity Disabilities

The problems faced by people with upper body mobility disabilities are similar to those who have speech disabilities. They may not be able to manipulate the standard phones and may need to use their own personal phones. This would trigger the same types of interoperability/connectivity issues discussed above.

On the other hand, if mainstream telecommunication devices and systems allow for the connection of alternate interfaces, this could allow individuals with mobility issues to move about with just a personal interface that they could use with all of the mainstream information and communication technologies they encounter. As we move to ubiquitous computing where computer technologies are built into everything around us, the ability for people to use their own personal interface with all of the devices they encounter can be a much more powerful approach than having to carry around with them their own personal accessible version of all of these technologies and systems. In addition, for security reasons, they may not be allowed to use their own versions of devices. They may be required to use the devices they find in their environment. International standards such as the new ISO/IEC 24752 provide standard ways of building interface sockets into appliances. These 'interface sockets' allow alternate interfaces to be used with the products. If an interface socket were provided, it would allow individuals with all disabilities to be able to access the product from their own personal interfaces.

Blindness and Low Vision

When thinking about access to broadband information and services, and particularly the Internet and World Wide Web, individuals with blindness and low vision are usually the first to come to mind. Individuals who are blind face a very obvious barrier in accessing the visual content of the web unless they have some type of special adaptive interface. And the cost for adaptive interfaces that can work with advanced technologies on the web is very high. Some types of content for example, require screen readers that cost in excess of $1,000 (higher than the price of computer it provides access to). And it is

critical for web pages to be designed properly or else even these very expensive technologies cannot access and present the information to users.

Currently only a relatively small fraction of individuals who are blind or have low vision and need special technologies to be able to access the web have or can afford (directly or through their funding mechanisms) technologies which are powerful enough to access the full range of information that is on the web today. Furthermore, the technologies that are coming to the web in the near future will put increasing amounts of everyday information out of reach of today's technologies. Unless this new content is designed in a fashion that is accessible by and through technologies that are affordable to individuals who are blind and have low vision, increasing amounts of information will move away from being accessible.

Deaf-Blindness

Individuals who are deaf-blind constitute the smallest of the major populations of people with disabilities and, as such, are the smallest market in this field of small markets. They also present one of the most challenging accessibility problems outside of certain cognitive language and learning disabilities. The difficulty of the problem coupled with the low population size has resulted in less effective solutions at higher costs, which usually also appear later than solutions for other disabilities.

Efforts to lower the cost for screen reading technologies can, if done in a fashion that is open, also decrease the costs for solutions for individuals that are deaf-blind. The development of common core Braille software components that are free and open source can also help to lower these costs.

The primary barrier on the content side is ensuring that all content and services are available in an all text format that can be translated into Braille or, in the future, into tactile sign.

The FCC has asked whether IP TRS would be useful to people who are deaf-blind. IP TRS would indeed be useful, as would any other all-text communication systems and services. Real-time IP TRS would allow individuals who are deaf-blind to have the information presented to them continuously in blocks (i.e. characters, words, sentences) of their preference to facilitate timely communications. It would also be helpful to deaf-blind persons to allow the use of more than one type of relay service in completion of a call. The disparity between what deaf-blind people can use and what others can use is great – and may require the use of two different relay services.

Cognitive Language and Learning Disabilities

This is the most challenging of all the disability areas. We are just beginning to create some effective access technologies, and guidelines for creating more accessible content for this population are still evolving.

The biggest accessibility barriers for people with cognitive language and learning disabilities appear to be complexity, lack of assistive technology and access features, the diversity in the types and degrees of cognitive language and learning disabilities combinations, and the high cost of entry for new companies interested in addressing this area.

A key requirement for web applications for this area is that they be adaptable. It will be a long time before assistive technologies will be powerful and intelligent enough to be able to make complex content and interfaces simple. Rather, web applications must know something about the individual user's capabilities and preferences and be able to deliver something that will fit the needs of that person. Or an alternate interface needs to be served from another source. This alone emphasizes the urgent need for a global web infrastructure that is adaptable and personalized. It also means that we need services freely available on the web to deliver alternatives for complex content, matching algorithms for content aggregators, and flexible layout managers. Web solutions need to

be context aware to be able to adapt to the user's environment, which will change throughout the day.

Since the Cognitive RERC will be submitting comments we will demur to their further points on this matter, other than noting that developing the full range of applications for individuals with cognitive language and learning disabilities will require more information than is required for screen readers, posing a significant challenge for companies trying to enter this field. Creating effective yet affordable solutions for this group is critical.

FCC Questions on Technical Solutions

The Importance of Keeping Ahead of the Technology Curve

The FCC comments cited the importance of 'staying ahead of technology'. We would reinforce the importance of this. Because technology moves so much faster than policy, it is critical to create policy that can make sense and be effective in the future. Policies must also, however, be effective today and during the transition.

Some have advocated for not adopting specific policies at this time because technologies will change in the future. This makes little sense, however, because technologies will *always* be different in the future and individuals need access today as much as individuals will need access in the future. Rather, policy must set both clear objectives for today and provide a path for evolving access in the future. This is typically done by creating clear guidance for today that is consistent with the longer-term objectives and then doing periodic updates along a predictable trajectory. In this way, guidance that is recommended today could be used to preview requirements in the future. Alternatively, requirements could be staged over time to allow companies to both predict and prepare.

As discussed earlier, providing access to broadband information and services should not be based upon the role of broadband today, but rather what the role of broadband is likely to be in the not too distant future. Most of those looking at the technology evolution

predict that broadband and network technologies will rapidly expand into most every aspect of life and that access to broadband and network devices and services will be essential for most any activity.

As this occurs, many of the information technologies and services will cease to be focused around particular devices and begin to be integrated into our environments. As such, the current approach to accessibility where we adapt individual devices to accommodate individual people will no longer be viable or effective. People will need to be able to access and use any of the devices in their environment. That is, as we move toward ubiquitous or built in computing we will also need to move toward ubiquitous or built in accessibility. Individuals need to be able to invoke the access features they need on the different electronic interfaces they encounter throughout their day in all of their work, education, transportation, community and daily living environments.

What Technical Issues Do We Need To Consider As We Formulate Policy Recommendations?

Probably the most important technology issue immediately in front of the commission is ***net neutrality***. As discussed earlier in this submission and in the testimony before the Canadian Radio-television and Telecommunications Commission (CRTC), net neutrality can have significant impact on not only the devices that people with disabilities can use but also the sources of information they may need to tap in order to secure services that they are able to use.

Another technical issue is ***scalability***. If we are already running short of funds to address the needs of people with disabilities and if we are currently only providing access to 15 or 20% of those who require it, we need to not only identify strategies that will work with future technologies, but to identify strategies for developing, distributing and supporting these technologies that can scale better than existing techniques. Wherever possible, we should look for ways to avoid duplicating effort and take advantage of the network and cloud technologies to decrease costs, capitalize on Moore's Law and harness the power of

networked communities to better employ our resources. Benetech's Bookshare[6] project that allows users and organizations that create accessible versions of materials to legally share them with each other through a web based library is an example of a project that is able to scale up rapidly while driving down costs.

Policies should also begin to incorporate and support the concept of ***crowd sourcing.*** As we move to an 'always connected' world, the ability to have support services on demand (both computer and human based services) will become possible and a potentially powerful new tool. Through peer-networks and volunteer crowd-sourced assistive services, whole new capabilities for supporting users with disabilities will emerge. Policies should promote these new opportunities and not inadvertently hinder them.

The FCC should also keep in mind the potential of assistance-on-demand as both a facilitator of work-at-home employment for people with disabilities and as job opportunities for people with disabilities to assist other people with the same or different disabilities. Such assistance-on-demand services could allow a person to get any type of assistance they need (visual, speech to text, cognitive assistance, etc) at the press of a button when confronted by a problem in person or when on a call or tele-meeting. This may have implications for call routing, allowable (or required) support for such services from distributed rather than central locations, reimbursement policies, and SIP/VoIP infrastructure.

Information is sought on what the National Public Inclusive Infrastructure might look like, how it would work, what it might cost and whether it should be included in the national broadband plan.

National Public Inclusive Infrastructure

The NPII would be a systematic building of accessibility directly into the nation's broadband infrastructure so that anyone, anywhere could approach any computer or

[6] www.bookshare.org

computerized interface and be able to invoke the interface features they need in order to access and use the computer, mobile device, etc.

The concept of a functionally inclusive infrastructure consists of two parts:

1. A ***National Public Inclusive Infrastructure*** (NPII) that provides a basic structure, tools and resources, and

2. ***A rich development ecosystem for accessibility products and features,*** consisting of commercial AT companies, mainstream information and communication technology (ICT) companies, free and open source developers, and individual consumers, researchers, and others all developing new accessibility products, features and services.

The ***National Public Inclusive Infrastructure*** (NPII) would be largely publicly funded and provide

1. **A mechanism for personal preference profiles** that allows individuals to create, store and use (in a secure and private manner) information that specifies what types of interface features they need.
2. **A mechanism for virtual distribution** of both commercial AT and public access features such that anyone can invoke the access features (AT and free) that they need on any computing device they encounter, anytime, anywhere based on their preference profile (and whichever commercial AT they are eligible to use through purchase or other funding).
3. **An open source set of tools and a rich development environment** that allows AT manufacturers, mainstream ICT companies, free and open source developers, researchers, consumers and other professionals to all build more diverse and inter-compatible alternate interfaces and services for less cost. The nature of the open source license for the code resources would be such that it allowed incorporation of all resources in both open and proprietary commercial products.
4. **A rich, diverse, and ongoing outreach/awareness program** to ensure that all those who need special interfaces are aware that they exist, can be used on the systems around them, and are free at their basic level (with more advanced commercial versions available as well).
5. **A set of copyright and related laws and regulations** that protect authors and distributors' rights while allowing people to access information and services in forms that are usable to them.

Note: The NPII itself would not develop end user interfaces but would only provide the infrastructure and tools. The alternate user interfaces and features would be developed by the ecosystem.

The ***rich development ecosystem for accessibility products and features*** would be privately funded (except for government grants for research efforts) and would include:

a. **Commercial AT manufacturers** who would now have better tools, more compatibility with other access features, core mainstream ICT compatibility components that they can use to reduce their development costs (especially the cost to keep up with all the new mainstream technologies), a virtual distribution system that can take them into the future, and a larger market for their products due to increased awareness of accessibility by those who need it.

b. **New and smaller AT manufacturers,** which will become more prevalent due to the lower cost to develop AT or free access features and the ready distribution system to make them available.

c. **Mainstream ICT companies** who could use NPII tools to both incorporate built-in access in their products and to more easily make their products compatible with the rich set of access technologies that are created using NPII tools and resources. Companies could also reduce or eliminate the delay between a new product or technology introduction and the time when it is accessible. This could be done by working directly with the NPII core technologies to make them compatible with their new technologies prior to introduction.

d. **Open Source developers** who develop new access features and approaches and then release them for use and improvement by others. Some of these products are then sold commercially by the developers or others, often packaged with other products or with support. Because they are open source, all are available as free products or features.

e. **Free but proprietary developers** who develop closed products or features that they make available without charge. These will often be companies that that also sell commercial products in the same or related areas. These free products may be released to address the needs of people who do not have the resources to purchase commercial versions. They may be released to address a small market that otherwise would not be addressed. Or they may be released as “lite” versions of products that are used to entice users into more full featured versions if they need and can afford them. Or any combination of the above.

f. **Researchers** who can use the NPII tools and system to quickly and cost effectively experiment with, develop and/or test new idea or approaches. The NPII tools allow them to build on what has been done and extend it in ways they could not if they had to build a system from scratch or without

good tools. It also can help them to bridge the 'Valley of Death'[7] between successful research and any appearance of the results in commercial or general public use.

g. **Consumers and friends** can directly participate in the design of next generation accessibility and have the ability to directly impact what is available to them and their peers. Using either their own skills and the NPII tools, or using their own knowledge and enlisting someone with the needed programming skills, they can explore and design their own approaches to access technologies or create entirely new types of products.

h. **Professionals in the field** can similarly use their knowledge of their clients to propose and commission new access ideas and techniques and see them realized in a fashion that can be used by their clients and others nationally and internationally.

i. **Other countries and cultures** that do not have a rich or even adequate set of access technologies and features can use the NPII tools to 'localize' access technologies to work with their languages and culture.

Benefits of an National Public Inclusive Infrastructure

A National Public Inclusive Infrastructure could

1. Lower the cost to develop new or updated assistive technologies and features
2. Facilitate the development of access for underserved disability populations
3. Lower the cost to governments and others who want to provide access to all they serve.
4. Make it easier (less expensive and more realistic) for libraries and other public access points to have the interface adaptability they need to serve all patrons.
5. Increase the number and variety of developers and invigorate the field
6. Provide a path to accessibility for the future when ubiquitous computing is the norm

The NPII, if successful, has the potential to reinvent the topic of accessibility, universal design and assistive technology for information and communication technologies in the same way that the Internet caused a reinvention of information technology and the

[7] The 'valley of death' has been used to describe the problems that result in relatively few research results making it out of the lab and into common practice or commercial production. See
http://www.nsf.gov/attachments/111302/public/5-Pancake.pdf
http://www.nsf.gov/attachments/114545/public/Industry_University_Partnerships.pdf

iPhone, with its development tools and App store, reinvented smart phones and mobile information/communication technologies.

It can break open the field, greatly accelerate innovation, help bridge the "valley of death" between research and utilization/availability to people who need it, and allow consumers, clinicians, researchers and others with new ideas and different approaches to be able to participate more directly. It can eliminate or reduce duplicated effort around core activities such as mainstream IT, their operability and allow the attention, focus and funds to be focused on better interfaces for individuals with more types, degrees and accommodations of disability.

It can allow us to move away from the concept of special "assistive technologies" and "disability access features" as we know them today and toward (commercial) alternate interfaces and "inclusive design" which provide more interface options for everyone, interfaces that work for people having trouble using products due to disability, literacy or age related problems. It could also help people who just want a simpler interface, have a temporary disability, want access when their eyes are busy doing something else, want to rest their hands or eyes, want to access information in a silenced or very noisy environment, etc. It doesn't break out people with disabilities or those who are older because of their disabilities but rather provides interfaces that they can use allowing them to emphasize and capitalize on their abilities.

And by focusing on the core technological aspect in the NPII (and leaving human service intensive one layer out) the cost for the NPII itself can be contained and scales. As more and more people take advantage, the costs per user drop. And as technology advances the costs for use of the NPII would continually drop as well.

Finally, since the human physiology and senses are the same throughout the world as is the nature of information, the technologies used to build the NPII in one country will largely be the same for all countries. This not only allow countries to work together to lower the cost per country to implement a national public inclusive infrastructure but also

allows countries with more resources to be able to create a global public inclusive infrastructure by linking their efforts in a way that allows developing countries to either replicate and localize infrastructures for their countries or to share the NPII or global public inclusive infrastructure with countries using the same or similar languages.

Cost for an National Public Inclusive Infrastructure and for Access Implementations (products and free public features)

Note that providing access includes both the existence of the National Public Inclusive Infrastructure and commercial and free public access technologies and services that would be distributed through it. Only those things that cannot be done by individual developers, companies, etc. are included in the NPII itself. The individual commercial assistive technologies and free public access features and services would be funded separately.

While the cost for the NPII is not yet known, by limiting the NPII to developing the infrastructure and the tools (and leaving the development and support to the ecosystem) the cost for the NPII itself can be contained and could go down over time even as usage goes up. The government can then decide which aspects of development and support it wants to fund – either as commercial products or as free public features and services. The private sector is also expected to contribute to this second component of the solution.

The Trace Center, in conjunction with the Raising the Floor initiative, is preparing a white paper, expected to be released soon, describing the NPII concept in more detail. We are currently working with researchers and industry (AT and mainstream) to determine what it would cost to create and operate the NPII. The Raising the Floor initiative is interested in both creating an NPII and in fostering the development of free and open source access features and tools that could be distributed through an NPII.

FCC Questions on Equipment and Software

In looking at equipment and software what should we focus on?

Interoperability

A key issue for FCC focus is interoperability. Interoperability is not something that can be done by individual companies or even sectors. Nor can interoperability be mandated on a functional level. That is, one cannot require individual companies to develop their own interoperability solutions. Interoperability can only be achieved if there is a clear central definition of what is required and high motivation to follow it.

Interoperability of voice communications occurs because of the high market pressure and extensive efforts on the part of industry. In areas where there is no such natural market pressure the FCC will need to provide and enforce guidance if there is to be any interoperability.

With regard to VoIP and related technologies (e.g.; VoIP, real-time text, and video) there is no natural industry advocate for interoperability (such mainstream industry for voice or the AT industry for AT-IT interoperability) and the FCC will need to play a particularly clear role in establishing formats that all must follow in order to have interoperable real-time text and video. Clear action on the part of the FCC at this early stage can help prevent the promulgation of multiple competing standards, each implemented by different players. If a common standard is not specified now, and multiple standards are implemented – then the FCC may find itself in the difficult position of having to pick one of the standards as the common standard that all must support (and give advantage to some company over another) or end up requiring that everyone support multiple standards in order to achieve interoperability. This complicates the process for everyone and increases the cost. The FCC has an opportunity now to move early and establish interoperability from the beginning, where it can be built into the system at lower cost than retrofitting. It will also result in a more reliable solution than retrofitting or requiring that everybody support multiple formats.

Open Standards and Common Implementation Components

We also urge the use of open standards and common open source components in the construction of accessibility solutions. The use of open standards and common components can facilitate compatibility, interoperability, and competition by allowing different sectors to work more easily together and different companies to compete with each other using different, but compatible, technical approaches.

Participation By Consumers and Consumer Representatives in the Standards Process

Increasingly, we are turning to the standards approach for developing both technologies and guidelines. Unfortunately, the consumers are not provided with an equal voice in the setting of most standards. The resources of industry far exceed the resources that can be brought to bear by consumer groups and attempts to secure subsidization of consumer and consumer representatives in the standards process have been turned down. Some standards, in fact, are developed in committees in which consumers are not allowed to participate, either by membership rules or by not providing access accommodations to enable participation. It is recommended that where standards are to be used in policy, the consumers who will be impacted by that policy somehow be provided with an equal voice in developing the standards.

How much should we be looking to universal design versus assistive technology for providing access?

Universal design, or building accessibility directly into mainstream products, is by far the preferred approach where it is possible, effective, and commercially practical. With universal design, individuals with disability pay no more for access than everyone else. They don't have to secure special funding before they can access the product. They don't have the problem of being unable to access the various products and systems they

encounter in their environment (because each one isn't adapted to them – and they don't have funds, permission, or time to adapt them all as they encounter them). They don't have to wait after a new mainstream technology is introduced before adaptive technologies can be developed to work with that technology. They don't have to be locked out of products for which assistive technologies are not provided because they don't constitute enough of a market for AT vendors to be able to address them. They don't have to bear the stigma of using a "special" device in order to operate everyday devices, systems, or services. They are more attractive to employers because employers do not have to adapt their systems or acquire new technologies or software each time they are hired, change their job within the company or are promoted to jobs that would require the use of new technologies or software. Companies also don't have to worry about having to adapt each new technology they want to deploy in their environment or hold up deployment while accessibility for new technologies becomes available (or leave an employee with a disability offline until it is available). Older Americans, who are either unwilling to admit or unaware that they have a disability, can use the products because its built-in settings allow them to use it without external adaptation. As we move to ubiquitous computing accessibility, universal design allows accessibility to be built right into the different systems and devices that people with disabilities will encounter throughout their day.

However, it is not practical to build access for everyone into every product. Individuals requiring a Braille display, for example, would not expect that every interface on every device would have a Braille display included. Individuals who use direct brain control or who must have some special switches that are mounted to their wheelchair or on their person would not expect these special interfaces to be present wherever they go unless they bring these devices with them.

There is also a limit to how many different interfaces and variations each individual company would be expected to implement in each of their products. They simply wouldn't have the expertise to include every single one for every disability, and the range of different specialized interfaces is too great.

For mild to moderate disabilities however, interface flexibility can usually be built into products sufficiently to allow most people to have usable access to the products. Universal design can be used effectively for this group, especially for public information systems, fare machines, hotel thermostats and general home technology use. However, for applications where high efficiency is needed for work or other high performance settings, assistive technologies may be used to provide an interface that is tuned to the task and environment.

For individuals with more severe disabilities or combinations of disabilities, assistive technologies may also be needed for basic access. In these cases, "built-in access" may take the form of built-in compatibility, rather than a built-in interface itself. For workstations, this may take the form of an accessibility API that enables individuals to install special software or connect special hardware to provide a specialized and tuned interface for the individual. In other locations it may take the form of a software interface socket where users can connect to the washer, dryer, stove, thermostat, ticket machine, etc. using wireless networking technologies to be able to use their own custom interface technology to control the computer kiosk, telephone, etc.

The National Public Inclusive Infrastructure discussed above would be a hybrid of universal design and this type of assistive technology. With NPII, accessibility would be built-in (and therefore be like universal design). But rather than being built into each specific device itself, access features would be built into the overall broadband infrastructure. Using this approach, a much richer set of interfaces could be available than could be provided by any one company. Companies, by ensuring that their products worked with the NPII, would have the guarantee and satisfaction of knowing that their products are broadly accessible without have to worry about building, designing or keep up with advances in accessible interfaces. Specialized development tools provided by the NPII would both facilitate companies' ability to stay compatible with NPII-based AT and public access features. Finally, this generic approach (using the NPII to provide access)

will allow legacy products to work with new accessibility tools and services as they become practical and available.

Other Questions

We offer the following additional matters for consideration in response to the Commission's request for topics not addressed in the Notice.

1. How can policy be structured so that it ensures access to emergency services, education, the political process, and everything needed for daily life today yet not lock us into solutions which are obsolete over time, or prevent the use of better solution strategies in the future as they evolve? Technology is changing so rapidly that new opportunities for solving these problems will evolve in the future (as will new barriers). Yet doing nothing today, because something better may come in the future, would be like ceasing the introductions of all new products because better products will be available in the future.

2. The financial resources of people with disabilities and their organizations to participate in standards and policy processes are always strained. How can the Commission create processes to ensure that consumers have an equal voice to industry, government, and other entities that might be reluctant with respect to addressing accessibility requirements? (This is particularly important where there is no business case to be made to include features in mainstream products without regulation. This is often the situation when it comes to universal design for individuals with more than very mild disabilities.)

3. Are there strategies or actions that the Commission or the Congress can take that can both increase accessibility yet reduce the cost and effort needed by companies, governments, and others to provide accessibility?

4. How do the current copyright laws and licensing practices facilitate or create barriers to the use of existing or future accessibility techniques or practices?

Conclusion

If access to the Internet and its information, services, communication technologies, and communities is in fact no longer optional then providing access for everyone is also no longer optional. We need to be moving with diligence toward measures and policies that can guarantee that all constituents can have access. Relative population sizes for different groups may define markets but should not dictate or prioritize policy.

Moreover, if access to these resources for information, education, training, and peer support are keys to allowing individuals with disabilities or literacy problems to develop the skills they need to become employed or allow elders to stay active and participating and contributing, then it is in our economic best interest to ensure that these technologies are accessible and usable by these populations.

It is critical for the FCC to make recommendations in the National Broadband Plan that address the broadband needs of all Americans with disabilities - including those who have little or no resources to pay for access technologies. It is also important to think about where the Internet is going and to recommend those changes in the infrastructure that must be taken on a national basis and cannot be done by individual parties. This is an important role of government and one that cannot be fulfilled through other means. The above proposals offer considerable guidance to ensure that these individuals can effectively use broadband services and equipment to communicate, live independently and be productive – both now and in the future.

Respectfully Submitted,

/s/

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